IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent Application

Applicant(s): Kopmeiners et al.
Case: 8-3-4
Serial No.: 10/562,620
Filing Date: May 26, 2006
Group: 2473
Examiner: Candal Elpenord

Title: Methods and Apparatus for Backwards Compatible Communication in a Multiple Antenna Communication System Using Time Orthogonal Symbols

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APPEAL BRIEF

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Applicants hereby appeal the final rejection dated March 31, 2010, of claims 1-4, 7-19, and 22-29 of the above-identified patent application.

REAL PARTY IN INTEREST

The present application is assigned to Agere Systems Inc., as evidenced by an assignment recorded on May 24, 2006 in the United States Patent and Trademark Office at Reel 017680, Frame 0641. The assignee, Agere Systems Inc., is the real party in interest.

RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences.

STATUS OF CLAIMS

The present application was filed on May 26, 2006 with claims 1 through 29. Claims 5, 6, 20, and 21 were cancelled in the Amendment After Final Rejection dated April 10,

2009. Claims 1-4, 7-19, and 22-29 are presently pending in the above-identified patent application. Claims 1-4, 7-11, 13-15 and 16-25 are rejected under 35 U.S.C. §103(a) as being unpatentable over Perahia et al. (United States Patent No. 7,352,688) in view of Li et al. (United States Publication No. 2004/0258025; hereinafter Li '025) and further in view of Li et al. (United States Publication No. 2003/0016621; hereinafter Li '621), claim 12 is rejected under 35 U.S.C. §103(a) as being unpatentable over Perahia et al. in view of Li '025 and Li '621 as applied to claim 1 and further in view of Gardner et al. (United States Publication No. 2005/0233709), and claims 26-29 are rejected under 35 U.S.C. §103(a) as being unpatentable over Perahia et al. in view of Gardner et al. and further view of Li '025 and Kuchi et al. (United States Patent No. 7,065,156).

Claims 1, 10, 12, 16, 25, 26, and 29 are being appealed.

STATUS OF AMENDMENTS

There have been no amendments filed subsequent to the final rejection.

SUMMARY OF CLAIMED SUBJECT MATTER

Independent claim 1 is directed to a method for transmitting data in a multiple antenna communication system (FIG. 1; page 4, lines 13-21) having N transmit antennas (FIG. 1: 110), the method comprising the step of:

transmitting a legacy preamble and at least one additional long training symbol on each of the N transmit antennas (page 6, lines 11-13), wherein the legacy preamble comprises at least one long training symbol (page 6, lines 18-22), wherein a sequence of each of the long training symbols on each of the N transmit antennas are orthogonal (page 6, lines 14-15), and wherein each of the long training symbols are time orthogonal by introducing a phase shift between at least two of the training symbols transmitted on one of the N transmit antennas (page 8, line 15, to page 9, line 5).

Claims 10 and 25 require transmitting a field indicating the number N of transmit antennas (page 9, lines 20-22).

Claim 12 requires transmitting a field identifying channel bonding options (page 9, lines 22-24).

Independent claim 16 is directed to a transmitter in a multiple antenna communication system (FIG. 1; page 4, lines 13-21), comprising:

a transmitter circuit (FIG. 1); and

N transmit antennas (FIG. 1: 110) for transmitting a legacy preamble and at least one additional long training symbol on each of the N transmit antennas (page 6, lines 11-13), wherein the legacy preamble comprises at least one long training symbol (page 6, lines 18-22), wherein each of the long training symbols are orthogonal (page 6, lines 14-15), and wherein each of the long training symbols are time orthogonal by introducing a phase shift between at least two of the training symbols transmitted on one of the N transmit antennas (page 8, line 15, to page 9, line 5).

Independent claim 26 is directed to a method for receiving data on at least one receive antenna (FIG. 1: 115) transmitted by a transmitter having N transmit antennas (FIG. 1: 110) in a multiple antenna communication system (FIG. 1; page 4, lines 13-21), the method comprising the steps of:

receiving a legacy preamble and at least one additional long training symbol on each of the N transmit antennas (page 6, lines 11-13), wherein the legacy preamble comprises at least one long training symbol (page 6, lines 18-22) and an indication of a duration of a transmission of the data (page 5, lines 4-18), wherein a sequence of each of the long training symbols on each of the N transmit antennas are orthogonal (page 6, lines 14-15), the legacy preamble transmitted such that the indication of a duration is capable of being interpreted by a lower order receiver, and wherein each of the long training symbols are time orthogonal due to a phase shift that was introduced between at least two of the training symbols transmitted on one of the N transmit antennas (page 8, line 15, to page 9, line 5); and

deferring for the indicated duration (page 5, lines 14-30).

Independent claim 29 is directed to a receiver in a multiple antenna communication system (FIG. 1; page 4, lines 13-21) having at least one transmitter having N transmit antennas, comprising:

a receiver circuit (FIG. 8); and

at least one receive antenna for receiving a legacy preamble and at least one additional long training symbol on each of the N transmit antennas (page 6, lines 11-13), wherein the legacy preamble comprises at least one long training symbol (page 6, lines 18-22) and an

indication of a duration of a transmission of the data, wherein a sequence of each of the long training symbols on each of the N transmit antennas are orthogonal (page 6, lines 14-15), the legacy preamble transmitted such that the indication of a duration is capable of being interpreted by a lower order receiver, and wherein each of the long training symbols are time orthogonal due to a phase shift that was introduced between at least two of the training symbols transmitted on one of the N transmit antennas (page 8, line 15, to page 9, line 5); and

means for deferring for the indicated duration.

STATEMENT OF GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Claims 1-4, 7-11, 13-15 and 16-25 are rejected under 35 U.S.C. §103(a) as being unpatentable over Perahia et al. in view of Li '025 and further in view of Li '621, claim 12 is rejected under 35 U.S.C. §103(a) as being unpatentable over Perahia et al. in view of Li '025 and Li '621 as applied to claim 1 and further in view of Gardner et al., and claims 26-29 are rejected under 35 U.S.C. §103(a) as being unpatentable over Perahia et al. in view of Gardner et al. and further view of Li '025 and Kuchi et al.

ARGUMENT

Independent Claims

Independent claims 1 and 16 were rejected under 35 U.S.C. §103(a) as being unpatentable over Perahia et al. in view of Li '025 and further in view of Li '621, and claims 26 and 29 were rejected under 35 U.S.C. §103(a) as being unpatentable over Perahia et al. in view of Gardner et al. and further view of Li '025 and Kuchi. Regarding claims 1 and 16, the Examiner asserts that Li '621 discloses wherein each of the long training symbols are time orthogonal by introducing a phase shift between at least two of said training symbols (phase shift of the first and second training symbols, claims 5-7) transmitted on one of the N transmit antennas (FIG. 1; OFDM transmit antennas 130-1 to 130-N; paragraphs [0021] and [0023]).

Appellants note that, in the text cited by the Examiner, Li '621 teaches:

> [0021] FIG. 1 is a block diagram of an exemplary transmission system 100. The transmission system 100 includes an encoder 110 having a number of associated OFDM transmitters 120-1, 120-2, . . . 120-N and respective transmit antennas 130-1, 130-2, . . . 130-N, and an equalizer 160 having a number of associated

> OFDM receivers 150-1, 150-2, . . . 150-M with respective receive antennas 140-1, 140-2, . . . 140-M.
>
> [0023] As shown in FIG. 1, the radio-frequency signals 135 transmitted by each transmit antenna 130-1, 130-2, . . . 130-N can be subsequently received by each of the receiving antennas 140-1, 140-2, . . . 140-M. While FIG. 1 depicts the various communication channels as single direct paths between each transmit/receive antenna pair, it should be appreciated that each radio-frequency signal 135 can propagate from each transmit antenna 130-1, 130-2, . . . 130-N to each receive antenna 140-1, 140-2, . . . 140-M not only through a direct path, but can also propagate from each transmit antenna 130-1, 130-2, . . . 130-N to each receive antenna 140-1, 140-2, . . . 140-M through a variety of indirect paths (not shown).

Furthermore, claims 5-7 of Li '621 require, wherein at least one set of the one or more sets of second training symbols is substantially identical to the set of first training symbols with a phase shift, wherein every set of the one or more sets of second training symbols is substantially identical to the set of first training symbols with a respective phase shift, and wherein the first set of training signals is transmitted using a first transmit device and at least one of the one or more sets of second training signals is transmitted using a second transmitting device, respectively. Appellants find *no* disclosure or suggestion in Li '621 that *each of said long training symbols are time orthogonal by introducing a phase shift <u>between at least two of said training symbols transmitted on **one** of said N transmit antennas</u>.* To the contrary, Li '621 teaches that *"the exemplary sets of training symbols are transmitted according to an OFDM paradigm with the different sets of training symbols <u>using **different** transmit antennas</u>."* (Paragraph [0074]; emphasis added.)

Thus, even as combined in the manner suggested by the Examiner, Perahia et al., Gardner et al., Li '025, Li '621, and Kuchi *do not teach every element of the independent claims*. Furthermore, based on the KSR considerations discussed hereinafter, the combination/modification suggested by the Examiner is not appropriate.

<u>*KSR* Considerations</u>

An Examiner must establish "an apparent reason to combine … known elements." *KSR International Co. v. Teleflex Inc. (KSR)*, 550 U.S. ___, 82 USPQ2d 1385 (2007). Due to the lay-out of the Office Action, it is not clear what, if any, motivation for combining Li '621 with the other references is alleged by the Examiner.

Appellants, however, are claiming a new technique for transmitting data in a multiple antenna communication system having N transmit antennas, wherein the method

comprises the step of transmitting a legacy preamble and at least one additional long training symbol on each of the N transmit antennas, *wherein a sequence of each of the long training symbols on each of the N transmit antennas are orthogonal, and wherein each of the long training symbols are time orthogonal by introducing a phase shift between at least two of the training symbols transmitted on* ***one*** *of the N transmit antennas*.

There is no suggestion in Perahia et al., Gardner et al., Li et al., Li '621, or Kuchi, alone or in combination, that *each of said long training symbols are time orthogonal by introducing a phase shift* *between at least two of the training symbols transmitted on* ***one*** *of the N transmit antennas.*

Li's '621 teaching to transmit the *sets of training symbols according to an OFDM paradigm with the different sets of training symbols using* ***different*** *transmit antennas* ***teaches away*** from the present invention. The *KSR* Court discussed in some detail United States v. Adams, 383 U.S. 39 (1966), stating in part that in that case, "[t]he Court relied upon the corollary principle that when the prior art teaches away from combining certain known elements, discovery of a successful means of combining them is more likely to be nonobvious." (KSR Opinion at p. 12). Thus, there is no reason to make the asserted combination/modification.

Furthermore, in the Response to Arguments section of the final Office Action, the Examiner asserts that introducing a phase shift between training symbols where the training symbols are transmitted using (a) distinct set of antennas is well known in the art as evidenced by Kuchi. In particular, the Examiner asserts that Kuchi discloses "transmitting of symbol stream using first set of antenna (fig. 1b, 1c and fig. 3b-antenna phase 114a) and phase version of symbol stream is transmitted on a second set of antenna (fig. 1b, 1c and fig. 3b-antenna phase 114b), col. 2, lines 10-32, col. 5, lines 38-60."

As the Examiner acknowledges, Kuchi teaches that the phase version is transmitted on a different set of antennas; none of the cited references disclose or suggest that *each of said long training symbols are time orthogonal by introducing a phase shift between at least two of said training symbols transmitted on* ***one*** *of said N transmit antennas.*

Thus, Perahia et al., Gardner et al., Li '025, Li '621, and Kuchi, alone or in combination, do not disclose or suggest wherein each of said long training symbols are time orthogonal by introducing a phase shift between at least two of said training symbols transmitted on one of said N transmit antennas, as variously required by independent claims 1, 16, 26 and 29.

Claims 10 and 25

Claims 10 and 25 are rejected under 35 U.S.C. §103(a) as being unpatentable over Perahia et al. in view of Li '025 and further in view of Li '621. In particular, the Examiner asserts that Perahia discloses transmitting a field (FIGS. 5 and 6: elements 1, 2 identifying the distinct antennas by antenna elements 1, 2) indicating said number N of transmit antennas (transmitted long training symbols by antenna elements 1, 2; col. 6, lines 29-32; col. 8, lines 48-60).

In the text cited by the Examiner, Perahia teaches:

> FIG. 6 depicts another alternative preamble structure. Like the structure of FIG. 5, each of the two preambles begins with the short symbols 502. Here, however, the two transmitter antenna elements transmit long symbols simultaneously but using nonoverlapping subsets of subcarriers. For example, following the short symbols and a guard interval 602, *the first transmitter antenna element sends two long symbols 604* where the even subcarriers are set to their specified values while the odd subcarriers are set to zero. Simultaneously, the second transmitter antenna element transmits two successive long symbols 606 where the odd subcarriers are set to their specified values while the even subcarriers are set to zero.
> (Col. 8, lines 48-60; emphasis added.)

Perahia teaches to *transmit long training symbols*; Perahia does *not* teach to *transmit a field indicating the number N of transmit antennas*. Claims 10 and 25 require transmitting a field indicating said number N of transmit antennas.

Thus, Perahia et al., Gardner et al., Li '025, and Li '621, alone or in combination, do not disclose or suggest transmitting a field indicating said number N of transmit antennas, as required by claims 10 and 25.

Claim 12

Claim 12 is rejected under 35 U.S.C. §103(a) as being unpatentable over Perahia et al. in view of Li '025 and further in view of Li '621. In particular, the Examiner asserts that Gardner discloses transmitting a field identifying channel bonding options (transmission of signal using combination of extensions, paragraphs [0026]-[0034] and [0048]-[0049]).

In the text cited by the Examiner, Garder teaches:

> [0026] Combinations of Extensions
>
> [0027] Multi-channel extended 802.11 systems might simultaneously transmit on several 20 MHz channels, whereas a legacy 802.11 a system only transmits on a single 20 MHz channel using a single antenna, or if the legacy system does

transmit with more than one antenna, each of the antennas transmits the same 802.11a signal, possibly with some delay differences between signals. As a result, data rates can be increased over 802.11a data rates using multiple transmit antennas or multiple channels or a combination of both. Thus, in a communication channel, such as the airspace of a wireless network cloud, several types of packets might be present:

[0028] 1) Legacy SISO (single-input, single-output) 802.11a, 802.11b, or 802.11g packets transmitted in a single 20 MHz channel;

[0029] 2) Extended SISO in multiple 20 MHz channels (e.g., 40, 60, 80, or 100 MHz channels)

[0030] 3) Extended MIMO in a single 20 MHz channel;

[0031] 4) Extended MIMO in multiple 20 MHz channels (e.g., 40, 60, 80, or 100 MHz channels)

[0032] Several satisfactory modified preamble structures can be derived by one of ordinary skill in the art after reading this disclosure. Some examples are described below. Preferably, the unmodified preamble structure can provide interoperability and coexistence between SISO and MIMO systems at various channel widths and coexistence between extended mode systems and legacy systems.

[0033] MIMO Single Channel (20 MHz)

[0034] A modified preamble can use the same structure as the 802.11a preamble, with a different long training symbol determined from a long training symbol sequence LD. By keeping the same short symbols S and using the same timing structure as depicted in FIG. 1, a receiver using the extended mode can use the same hardware for detecting the repetitive S and L symbols, even though the actual contents of the L symbols may be different for the 802.11a extensions. (Paragraphs [0026]-[0034].)

As the Examiner acknowledges, Gardner teaches various combinations of extensions; Gardner does *not* disclose or suggest *channel bonding <u>options</u>* and does *not* disclose or suggest *transmitting a <u>field</u> identifying channel bonding <u>options</u>*. Claim 12 requires transmitting a field identifying channel bonding options.

Thus, Perahia et al., Gardner et al., Li ‘025, and Li ‘621, alone or in combination, do not disclose or suggest transmitting a field identifying channel bonding options, as required by claim 12.

Conclusion

The rejections of the cited claims under section 103 in view of Perahia et al., Gardner et al., Li '025, Li '621, and Kuchi et al., alone or in any combination, are therefore believed to be improper and should be withdrawn. The remaining rejected dependent claims are believed allowable for at least the reasons identified above with respect to the independent claims.

The attention of the Examiner and the Appeal Board to this matter is appreciated.

Respectfully,

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CLAIMS APPENDIX

1. A method for transmitting data in a multiple antenna communication system having N transmit antennas, said method comprising the step of:

transmitting a legacy preamble and at least one additional long training symbol on each of said N transmit antennas, wherein said legacy preamble comprises at least one long training symbol, wherein a sequence of each of said long training symbols on each of said N transmit antennas are orthogonal, and wherein each of said long training symbols are time orthogonal by introducing a phase shift between at least two of said training symbols transmitted on one of said N transmit antennas.

2. The method of claim 1, wherein said legacy preamble further comprises at least one short training symbol.

3. The method of claim 1, wherein said legacy preamble further comprises at least one SIGNAL field.

4. The method of claim 1, wherein said legacy preamble is an 802.11 a/g preamble.

5. (Cancelled)

6. (Cancelled)

7. The method of claim 1, wherein said phase shift is introduced to each of said long training symbols using a complex rotation.

8. The method of claim 1, wherein N is two and wherein said transmitting step further comprises the step of transmitting a legacy preamble having at least one long training symbol and one additional long training symbol on each of said two transmit antennas, wherein one of said transmit antennas transmits one of said long training symbols with a reversed polarity.

9. The method of claim 1, whereby a lower order receiver can interpret said transmitted data.

10. The method of claim 1, further comprising the step of transmitting a field indicating said number N of transmit antennas.

11. The method of claim 1, further comprising the step of transmitting a field identifying an employed coding scheme.

12. The method of claim 1, further comprising the step of transmitting a field identifying channel bonding options.

13. The method of claim 1, further comprising the step of transmitting a field identifying a long training symbol format.

14. The method of claim 1, wherein said legacy preamble has a shorter guard interval.

15. The method of claim 1, wherein said legacy preamble has a long training field containing only one long training symbol.

16. A transmitter in a multiple antenna communication system, comprising:

a transmitter circuit; and

N transmit antennas for transmitting a legacy preamble and at least one additional long training symbol on each of said N transmit antennas, wherein said legacy preamble comprises at least one long training symbol, wherein each of said long training symbols are orthogonal, and wherein each of said long training symbols are time orthogonal by introducing a phase shift between at least two of said training symbols transmitted on one of said N transmit antennas.

17. The transmitter of claim 16, wherein said legacy preamble further comprises at least one short training symbol.

18. The transmitter of claim 16, wherein said legacy preamble further comprises at least one SIGNAL field.

19. The transmitter of claim 16, wherein said legacy preamble is an 802.11 a/g preamble.

20. (Cancelled)

21. (Cancelled)

22. The transmitter of claim 16, wherein each of said time orthogonal long training symbols are stored in memory and said phase shift is introduced when said long training symbols are transmitted.

23. The transmitter of claim 16, wherein N is two and wherein said transmitting step further comprises the step of transmitting a legacy preamble having at least one long training symbol and one additional long training symbol on each of said two transmit antennas, wherein one of said transmit antennas transmits one of said long training symbols with a reversed polarity.

24. The transmitter of claim 16, whereby a lower order receiver can interpret said transmitted data.

25. The transmitter of claim 16, further comprising the step of transmitting a field indicating said number N of transmit antennas.

26. A method for receiving data on at least one receive antenna transmitted by a transmitter having N transmit antennas in a multiple antenna communication system, said method comprising the steps of:

receiving a legacy preamble and at least one additional long training symbol on each of said N transmit antennas, wherein said legacy preamble comprises at least one long

training symbol and an indication of a duration of a transmission of said data, wherein a sequence of each of said long training symbols on each of said N transmit antennas are orthogonal, said legacy preamble transmitted such that said indication of a duration is capable of being interpreted by a lower order receiver, and wherein each of said long training symbols are time orthogonal due to a phase shift that was introduced between at least two of said training symbols transmitted on one of said N transmit antennas; and

deferring for said indicated duration.

27. The method of claim 26, wherein said method is performed by a SISO receiver.

28. The method of claim 26, wherein said indication is transmitted in a SIGNAL field that complies with the 802.11 a/g standards.

29. A receiver in a multiple antenna communication system having at least one transmitter having N transmit antennas, comprising:

a receiver circuit; and

at least one receive antenna for receiving a legacy preamble and at least one additional long training symbol on each of said N transmit antennas, wherein said legacy preamble comprises at least one long training symbol and an indication of a duration of a transmission of said data, wherein a sequence of each of said long training symbols on each of said N transmit antennas are orthogonal, said legacy preamble transmitted such that said indication of a duration is capable of being interpreted by a lower order receiver, and wherein each of said long training symbols are time orthogonal due to a phase shift that was introduced between at least two of said training symbols transmitted on one of said N transmit antennas; and means for deferring for said indicated duration.

EVIDENCE APPENDIX

There is no evidence submitted pursuant to § 1.130, 1.131, or 1.132 or entered by the Examiner and relied upon by appellant.

RELATED PROCEEDINGS APPENDIX

There are no known decisions rendered by a court or the Board in any proceeding identified pursuant to paragraph (c)(1)(ii) of 37 CFR 41.37.